PATENT COOPERATION TREATY

PCT

REC'D 16 DEC 2004
WIPO PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P1672-100	FOR FURTHER ACTION See Form PCT/IPEA/416	
International application No. PCT/SE2003/001296	International filing date *(day/month/year)* 21.08.2003	Priority date *(day/month/year)* 06.09.2002
International Patent Classification (IPC) or national classification and IPC D21B 1/02		
Applicant STORA ENSO AB et al		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *(sent to the applicant and to the International Bureau)* a total of 3 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).
4. This report contains indications relating to the following items:
   - ☒ Box No. I Basis of the report
   - ☐ Box No. II Priority
   - ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - ☐ Box No. IV Lack of unity of invention
   - ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - ☐ Box No. VI Certain documents cited
   - ☐ Box No. VII Certain defects in the international application
   - ☐ Box No. VIII Certain observations on the international application

Date of submission of the demand	Date of completion of this report
06.02.2004	09.12.2004
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. +46 8 667 72 88	Authorized officer Susanna Lindfors/BS Telephone No. +46 8 782 25 00

Form PCT/IPEA/409 (cover sheet) (January 2004)

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/SE2003/001296

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This report is based on a translation from the original language into the following language _____, which is the language of a translation furnished for the purposes of:

☐ international search (under Rules 12.3 and 23.1(b))
☐ publication of the international application (under Rule 12.4)
☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

☐ the international application as originally filed/furnished

☒ the description:
pages 1 - 12 as originally filed/furnished
pages* _____ received by this Authority on _____
pages* _____ received by this Authority on _____

☒ the claims:
pages _____ as originally filed/furnished
pages* _____ as amended (together with any statement) under Article 19
pages* 13 - 15 received by this Authority on 29-11-2004
pages* _____ received by this Authority on _____

☒ the drawings:
pages 1 - 3 as originally filed/furnished
pages* _____ received by this Authority on _____
pages* _____ received by this Authority on _____

☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____
☐ the claims, Nos. _____
☐ the drawings, sheets/figs _____
☐ the sequence listing *(specify)*: _____
☐ any table(s) related to the sequence listing *(specify)*: _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

☐ the description, pages _____
☐ the claims, Nos. _____
☐ the drawings, sheets/figs _____
☐ the sequence listing *(specify)*: _____
☐ any table(s) related to the sequence listing *(specify)*: _____

* *If item 4 applies, some or all of those sheets may be marked "superseded."*

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/SE2003/001296

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1 - 21	YES
	Claims		NO
Inventive step (IS)	Claims	1 - 21	YES
	Claims		NO
Industrial applicability (IA)	Claims	1 - 21	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

The invention aims at providing a method of mechanical pulping requiring significantly reduced energy consumption to reach a certain pulp freeness or pulp strength. The method of the invention comprises initial compression of the fiber material and pretreatment of the comminuted cellulose fiber material with pectinase.

D1: EP 0430915 A1
D2: WO 8902951 A1
D3: WO 9220855 A1

D1 describes a procedure for the production of mechanical pulp from a fibrous product. The objective referred to in D1 is to reduce the energy consumption in the defibration and refining of wood. In the method disclosed in D1, wood, wood chips or pulp is subjected to enzyme treatment prior to the refining. The enzyme is intended to act on the hemicellulose and/or cellulose in the fibrous product. The enzyme to be used is preferably hemicellulase, cellulase, esterase, pectinase or a mixture of these.

D2 discloses a method of impregnating lignocellulose material, wherein the material first is compressed to such a degree that its pores are substantially compressed. The material then is allowed to expand in an impregnation liquid. When the pores are restored, the liquid is sucked into them.

D3 relates to a method for producing mechanical pulp by impregnation followed by refinement at a high temperature. The impregnation liquor contains a sodium sulphite and a

.../...

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of: Box V

sequestering agent, such as EDTA or DTPA, which improves the brightness of the pulp.

Although it is stated both in the description and in claims 4 and 13 of D1 that pectinase can be used for the purpose of reducing energy consumption and improving pulp properties, it has not been shown or discussed how to achieve such results. In D1, pectinase is mentioned as an example, among others, of a hydrolytic enzyme that decomposes cellulose and/or hemicellulose. However, this is an incorrect assumption on the action of pectinase. Further, no results are shown in D1 for the suggested use of pectinase.

Therefore, the use of pectinase in the method according to claim 1 is novel in view of D1.

Neither document D2 nor D3 refers to the impregnation of a fiber material with an aqueous liquid comprising pectinase.

The purpose of the enzyme treatment referred to in D1 is to decompose hemicellulose and/or cellulose. There is no indication in D1 that would lead a person skilled in the art to use an enzyme that acts on pectin.

Consequently, the method according to claim 1 is considered to involve an inventive step.

Thus, the method according to claims 1 - 21 is novel and considered to involve an inventive step. The method fulfils the requirement of industrial applicability.

CLAIMS

1. A method of producing mechanical pulp, comprising impregnation of fiber material with an enzyme-containing aqueous liquid prior to defibration and refining of the fiber material to produce a mechanical pulp, characterised in said enzyme-containing aqueous liquid being a pectinase-containing aqueous liquid and in initial compression of the fiber material.

2. A method according to claim 1, characterised in that said initial compression of the fiber material is a mechanical compression, preferably combined with a thermal pretreatment of the fiber material, preferably by steaming, before the impregnation.

3. A method according to claim 2, characterised in that steaming is carried out, preferably at atmospheric pressure, for 1 to 30 min, preferably 10 to 20 min.

4. A method according to claim 2 or 3, characterised in that compression is performed by a compression screw or a twin roll press, with a compression ratio of 1:1 to 8:1, preferably 2:1 to 5:1.

5. A method according to anyone of the preceding claims, characterised in that the pectinase-containing liquid comprises an enzymatic preparation with pectolytic activity for both pectins and esterified pectins.

6. A method according to anyone of the preceding claims, characterised in that the aqueous liquid comprises two or more enzymatic preparations wherein at least one of the preparations has pectinase activity.

7. A method according to anyone of claims 1-5, characterised in that the pectinase is added as a biological agent comprising one or more fungi or bacteria, at least one of which having pectolytic activity.

8. A method according to anyone of the preceding claims, characterised in that the pectinase arises from a group of microorganisms containing *Aspergillus aculeatus* and *Aspergillus oryzae*.

9. A method according to anyone of the preceding claims, characterised in that the charge of pectinase is 2,000,000 to 200,000,000 polygalacturonase units/ton

fiber material, preferably 10,000,000 to 50,000,000 polygalacturonase units/ton.

10. A method according to anyone of the preceding claims, characterised in that the aqueous liquid comprises at least one chelating agent, preferably diethylenetetraminepentaacetic acid at a charge of 1 to 10 kg/ton and/or sulfite at a charge of 5 to 50 kg/ton.

11. A method according to anyone of the preceding claims, characterised in that a retention time after uptake of the impregnation liquid is 3 min to 24 hours, preferably 15 to 240 min, and more preferably 30 to 120 min.

12. A method according to claim 11, characterised in that a temperature in the retention after uptake of the impregnation liquid is 20 to 100°C, preferably 35 to 70°C, and more preferably about 50°C.

13. A method according to anyone of the preceding claims, characterised in that a pH in the impregnation liquid is 3 to 10, preferably 4 to 7, and more preferably about 5.

14. A method according to anyone of the preceding claims, characterised in that the defibration and refining of the fiber material is performed by use of single disc, double disc or conical refiners in one or multi stages.

15. A method according to claim 14, characterised in that a refiner rotation speed is 1000 to 3000 rpm, preferably 1500 to 2600 rpm.

16. A method according to claim 14, characterised in that the fiber material is preheated for 2 to 10 min before refining, that a refiner pressure is from atmospheric up to 5 bar, preferably up to 4 bar and that a refiner rotation speed preferably is 1200 to 1800 rpm.

17. A method according to claim 14, characterised in that the fiber material is preheated for 3 to 30 sec before refining, that a refiner pressure is from 4 to 8 bar, preferably 5 to 8 bar and that a refiner rotation speed preferably is above 2000 rpm.

18. A method according to anyone of the preceding claims, characterised in that said fiber material is softwood chips or hardwood chips.

19. A method according to anyone of claims 1-17, characterised in that the fiber material is non-wood fiber material including bagasse, bamboo, reed and straw.

20. A method according to anyone of the preceding claims, characterised in that the pulp obtained after defibration and refining is bleached, preferably with alkaline peroxide, to obtain bleached pulp having high brightness.

21. Mechanical pulp, characterised in that it has been produced according to any one of claims 1-20.